

## Initial Statement of Reasons

### DEPARTMENT OF CALIFORNIA HIGHWAY PATROL

#### INITIAL STATEMENT OF REASONS - January 1994

#### Designation of Routes for the Transportation of Highway Route Controlled Quantity Shipments of Radioactive Materials (HMS-94-01)

Pursuant to Section 33000 of the California Vehicle Code, the Department of California Highway Patrol is establishing route designations for the through transportation of highway route controlled quantity shipments of radioactive materials. The federal government has established all interstate highways as approved routes; the Department of California Highway Patrol is proposing to designate only those routes necessary for through transportation.

#### PURPOSE OF REGULATIONS

Section 33000 of the California Vehicle Code mandates the California Highway Patrol to adopt regulations necessary to implement the routing of highway route controlled quantity shipments of radioactive materials.

The regulations contain maps identifying preferred routes for the transportation of highway route controlled quantity shipments of radioactive materials pursuant to Section 33000 of the California Vehicle Code.

#### LEGISLATIVE HISTORY

1959 Section 33000 and 33001 were added to the California Vehicle Code in September 1959. Section 33000 defined "Radioactive Materials" for the purposes of the California Vehicle Code. Section 33001 provided that the State Fire Marshal may adopt regulations that may promote the safe transportation of radioactive materials.

1961 In September 1961, Section 25651 was added to the Health & Safety Code. This Section provided that the Department of Health Services shall adopt regulations to promote the safe transportation of radioactive materials. The Section also included a provision that the regulations may include routes. Section 33000, California Vehicle Code was amended to require that the transportation of radioactive material comply with the provisions of the Health & Safety Code. Section 33001, California Vehicle Code relating to the State Fire Marshal's authority to adopt radioactive material regulations was repealed.

1981 In January 1981, Section 33000, California Vehicle Code and Section 25651, Health and Safety Code were amended. These sections provided that the California Highway Patrol shall adopt regulations specifying the routes to be used for the transportation of hazardous radioactive materials, as such materials are defined in regulations of the State Department of Health Services.

1991 In January of 1991, the Department of Health Services amended Title 17, Section 30100, California Code of Regulations defining "hazardous radioactive material" as "highway route controlled quantity" of radioactive materials, as defined in Title 49, Section 173.403, Code of Federal Regulations.

#### DEFINITIONS

- "Highway Route Controlled Quantity" - Defined in Title 49, Section 173.403, Code of Federal Regulations as a quantity within a single package which exceeds:
  - (1) 3000 times the  $A_1$  value of the radionuclides as specified in Section 173.433 for special form radioactive material;
  - (2) 3000 times the  $A_2$  value of the radionuclides as specified in Section 173.433 for normal form radioactive material; or
  - (3) 30,000 curies, whichever is least.

The following definitions are abstracted from Title 49, Part 173, Code of Federal Regulations:

- $A_1$  - The maximum activity of special form radioactive material permitted in a Type A package.
- $A_2$  - The maximum activity of radioactive material, other than special form or low specific activity radioactive material, permitted in a Type A package. These  $A_1$  and  $A_2$  values are either listed in Section 173.435 or may be derived in accordance with the procedure prescribed in Section 173.433.
- Special Form - Radioactive material that is prepackaged or encapsulated in a special form capsule that can only be opened by destroying the capsule. The criteria for a material meeting the definition of special form are found in Section 173.469, Special Tests. Tests include impact, percussion, bending, heating, leaching, and immersion. A complete certification and

supporting safety analysis must be available and on file by each shipper in compliance with Section 173.476.

- Normal Form - Radioactive materials that are not in special form are called normal form. Normal form materials are described in terms of physical form (solid, gas, powder, liquid, etc.) and chemical form (organic salt, nitrite, chloride, sludge, etc.).
- Type A Package - A Type A package defined as its packaging together with its limited radioactive contents. Type A package contents are limited to A<sub>1</sub> or A<sub>2</sub>.
- Type A Packaging - A packaging designed to retain the integrity of containment and shielding required by this part under normal conditions of transport as demonstrated by the tests set forth in Sections 173.465 or 173.466, as appropriate. Tests include: water spray (for 1 hour to simulate rainfall of 2 inches per hour), free drop (free fall onto a flat hard surface with distance specified according to packaging weight), compression (5 times the weight of the package for at least 24 hours), and penetration (impact from dropping a 13 pound bar (1-1/4 inch in diameter) vertically from a height of 3.3 feet). Each shipper of a Type A package is required to maintain on file a complete certification and supporting safety analysis that the construction methods, packaging design, and materials of construction are in compliance with the specifications.
- Type B Package - A Type B package is defined as its packaging together with its radioactive contents.
- Type B Packaging - A packaging designed to retain the integrity of containment and shielding required by this part when subjected to normal conditions or transport and hypothetical accident test conditions set forth in Title 10, Code of Federal Regulations, Part 71. This package must meet all Type A criteria and requirements plus provide adequate protection for serious accident conditions with limited loss of shielding and no loss of containment. The series of accident test requirements include: water immersion (under 15 meters for not less than 8 hours), free drop (from 30 feet onto a flat unyielding surface), puncture (a free drop of 40 inches onto a 6 inch diameter cylindrical steel bar), and thermal test (30 minutes at 1475°F). Only Type B packaging is used for highway route controlled quantity shipments.

the route selection criteria was changed to require use of interstate or state highways offering the least overall transit time whenever practicable.

**OVERVIEW OF FEDERAL AND STATE ROUTING REQUIREMENTS FOR HIGHWAY ROUTE CONTROLLED QUANTITY SHIPMENTS OF RADIOACTIVE MATERIALS**

The United States Department of Transportation has established specific highway routing requirements for highway route controlled quantity shipments of radioactive materials. These requirements are codified in Title 49, Code of Federal Regulations, Section 177.825(b), which states:

- (b) ...a carrier or any person operating a motor vehicle containing a highway route controlled quantity of radioactive materials...shall operate the motor vehicle only over preferred routes...selected...to reduce time in transit...
- (1) A preferred route is either or both an Interstate System highway for which an alternative route is not designated by a State routing agency...or a State designated route selected by a State routing agency...in accordance with the following conditions:
  - (i) The State routing agency shall select routes to minimize radiological risk using "Guidelines for selecting Preferred Highway Routes for Highway Route Controlled Quantity Shipments of Class 7 Radioactive Materials," or an equivalent routing analysis which adequately considers overall risk to the public....
  - (ii) State routing agencies may designate preferred routes as an alternative to, or in addition to, one or more Interstate System highways....

Title 49, Code of Federal Regulations, Section 177.825(b), provides authority for a state routing agency to "designate preferred routes as an alternative to, or in addition to, one or more Interstate System highways" for the transportation of highway route controlled quantity shipments of radioactive materials. In addition, designations of alternate preferred routes must be proceeded by substantive consultation with affected local jurisdictions and with any other affected states to ensure consideration of all impacts and continuity of designated routes.

Title 49, Code of Federal Regulations, Section 177.825(b)(2), provide conditions when motor vehicles may be operated over a route, other than a preferred route

while transporting highway route controlled quantity shipments of radioactive materials. Deviation from the preferred route may occur for the following: (1) necessary pickup and delivery, (2) necessary rest, fuel or motor vehicle repair stops, or (3) emergency conditions make continued use of the preferred route unsafe or impossible.

The responsibility for highway routing of hazardous materials, including Class 7 radioactive materials and the related preemption determination and-waiver of preemption procedures, has been delegated by the Secretary of Transportation to the Federal Highway Administration. The Federal Highway Administration incorporated, without substantive change, Research and Special Programs Administration's regulations at Title 49, Code of Federal Regulation, Section 107.201 to 102.227, and 177.825 into the Federal Highway's regulations at Title 49, Code of Federal Regulation, Part 397, subpart D and E, respectively.

Section 33000, California Vehicle Code requires the California Highway Patrol to adopt regulations designating routes for the transportation of cargoes of highway route controlled quantity shipments of radioactive materials.

#### STUDIES/RELATED FACTS

##### 1. Risk Assessment Methodology

The route risk assessments were conducted with consideration of existing federal and State routing requirements and in compliance with the U.S. Department of Transportation, Research and Special Programs Administration, "Guidelines for Selecting Preferred Highway Routes for Highway Route Controlled Quantity Shipments of Radioactive Materials" (DOT/RSPA/HMS/92-02, hereinafter referred to as the federal guidelines). Documentation of the methodology employed is contained in the California Highway Patrol's "Radioactive Materials Transportation Routing Study - Designation of Routes for the Through Transportation of Highway Route Controlled Quantity Shipments of Radioactive Materials."

##### • Federal Routing Guidelines:

*Primary Risk Factors* - Federal guidelines emphasize that the route selection should be based on the risk which is associated with the radiological nature of the cargo. This approach results in the selection of routes that minimize the total impact associated with normal exposure and the potential consequences of an accidental release of radioactive materials. Consequently, the following are considered by the federal guidelines to be the primary route comparison factors:

- Normal radiation exposure - Shipping packages containing radioactive materials emit radiation during transport. Sufficient shielding must be contained in the package to reduce this radiation to safe levels as specified in Department of Transportation regulations. Exposure could vary significantly among available routes and should be considered during route selection.
- Public health risks from accidents - Highway route controlled quantity shipments contain amounts of radioactive materials that are potentially harmful to the public if released. For this reason, these materials may only be transported in shipping packages (approved by the Department of Transportation, Department of Energy, or the Nuclear Regulatory Commission) designed to isolate the materials from the public, even in severe transportation accidents.
- Economic risk from accidents - A very severe transportation accident could also result in contamination of nearby property. The frequency of severe transportation accidents which could cause contamination must also be considered during route selection.

*Secondary Risk Factors* - Factors that are considered secondary to the basic goal of minimizing the radiological risk from transportation are identified below. These secondary factors may be useful to consider in the route selection process, but only after a careful analysis reveals that the alternative routes have essentially the same level of risk based on the three primary comparison factors. The secondary factors are:

- Emergency response capabilities - If a severe transportation accident results in radioactive material being released from the shipping package, actions by emergency response personnel can mitigate the potential consequences from the release. These factors could vary significantly among available routes.
- Evacuation - One method of mitigating the consequences of a radioactive material release is to evacuate those who could potentially be exposed to the material. The time and effort required to evacuate a segment of the population may vary among the available routes. Evacuation is often ordered as a precautionary measure if an accident occurs, even if a release has not been confirmed. Evacuation has economic impacts which may also be considered in comparing available routes.

- Location of special facilities - Some private and public facilities along transportation routes contain populations requiring special consideration when analyzing the potential effects of accidental releases of radioactive materials or exposure during transport. The number and type of such facilities (i.e. stadiums, schools and hospitals, etc.), provide a basis for comparing alternative routes.
- Traffic fatalities and injuries - Trucks carrying radioactive materials may be involved in traffic accidents, just like other vehicles. Routes that minimize these accidents would be preferred.

The "primary" route risk comparison factors formed the basis for route selection. The secondary factors were not used because clear-cut choices emerged from the evaluation of the primary factors.

- **Additional Routing Considerations:**

The California Highway Patrol contemplated additional routing considerations such as physical constraints of roadways; inadequate shoulders, turning radius for commercial vehicle traffic; and height, weight, and/or width restrictions. Legal constraints for consideration include factors such as bridges, tunnels, toll crossings, or highway restricted to the through transportation of hazardous materials/waste by administrative action pursuant to Section 31304, California Vehicle Code.

Time of day and day of week considerations are deferred to federal regulation currently found in Title 49 Section 177.825 (b) (2), Code of Federal Regulations.

## 2. Survey: Highway Route Controlled Quantity Shipments of Radioactive Materials Transportation

- **Purpose**

To conduct the comparative risk analyses necessary to evaluate alternate routes, it was necessary to identify common points of origin and destination for highway route controlled quantity shipments of radioactive materials. No such database or flow study existed that identified these points in California.

All facilities using radioactive materials, except those exclusively licensed by the Nuclear Regulatory Commission, are required to be licensed by the California Department of Health Services. The Department of Health

Services issues a Radioactive Materials License to those qualified facilities. The California Highway Patrol obtained a mailing list for 2,253 radioactive materials licensees<sup>1</sup> and mailed a survey questionnaire to each licensee. The survey requested the licensee to answer six questions relating to the transportation of highway route controlled quantity shipments of radioactive materials. The questions were as follows:

1. Identify by name, any highway route controlled quantity shipments of radioactive materials transported or received.
2. Provide an annual estimate of highway route controlled quantity shipments, by name, transported or received.
3. Identify the nearest major highway intersection to your facility.
4. If highway route controlled quantity shipments leave your facility, identify the nearest major highway intersection to the shipment destination. If the shipment leaves California, identify the highway used.
5. Provide the name(s) and address for each carrier that transports or delivers highway route controlled quantity shipments to/from your facility.
6. Identify the time of day and day of week your facility sends and or receives highway route controlled quantity shipments.

#### Survey Results:

The Hazardous Material Section received approximately 300 telephone calls and 130 completed questionnaires. Of the total responses received, seven licensees indicated they transported or received highway route controlled quantity shipments of radioactive materials.

The survey responses identified seven origin and destination points. Additional origin and destination points were identified through contacts with the California Department of Health Services, the Nuclear Regulatory Commission, the Department of Energy, and the Federal Highway Administration.

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<sup>1</sup>Licensees as of March 1993



### 3. Interested Party Mailing List

Fifty-three licensees completing the "Highway Route Controlled Quantity Shipments of Radioactive Materials Survey" requested to be included on an interested party mailing list. The mailing list was further expanded to include: consultative meeting invitees; administering agencies; local emergency responders along the proposed routes; California Department of Transportation Districts; State Regional Offices of Emergency Services; and other interested government agencies and private parties requesting information.

### 4. HazTrans®

To complete the required route risk assessments on approximately 2,434 miles of California highways (Interstate routes), the California Highway Patrol used HazTrans®, a computer based route risk assessment program developed by Abkowitz and Associates, Inc. in association with Vanderbilt University. The California Highway Patrol entered into a contract with Vanderbilt University in 1989 to provide a California specific version of this software. The routing methodology incorporated into the HazTrans® program exceeds the criteria established in the federal guidelines.

The HazTrans® contract includes the maintenance of this California unique database. HazTrans® allows for conducting route risk assessments with consideration of the following routing criteria: population exposure, distance, travel time, accident likelihood, risk and radiological risk.

HazTrans® provides the State of California with a flexible and easy-to-use, yet comprehensive tool for evaluating risks and selecting preferred routes associated with the transportation of highway route controlled quantity shipments of radioactive material. HazTrans® consists of two major components, a mapping system and an analysis methodology, which are fully integrated.

#### • HazTrans® Databases/Sources

The databases contained in the California version of HazTrans® were derived from the most current sources available. The following provides a description of the California specific data that was used in completing the required route risk assessments:

Road Network - In addition to using the HazTrans® national road network for California, other segments have been included in the California system so that all Interstates, U.S. Routes, State Routes, and selected major county roads in the State of California are contained in the network, as well as

points-of-entry from major routes of those states located adjacent to California.

*Accident Rates and Accident Likelihood* - Accident rates were derived from the California Department of Transportation, 1989 Route Segment Report, Volume 2. In that document, vehicle accident rates for each California highway segment are reported as a three-year historical average. This methodologically is desirable because it tends to smooth the effects of an unusual accident reporting year. These accident rates combine the likelihood of an accident with the likelihood of a release of the hazardous cargo given that an accident has occurred. Obviously, not all accidents will result in a release so that the release-causing accident rate will be somewhat lower than the vehicular accident rate. If truck accident rates were unavailable then accident rates were derived from those developed by the Federal Highway Administration for the different functional classifications that appear in the U.S. roadway network.

*Travel Time* - Travel times, also derived from the California Department of Transportation, 1989 Route Segment Report, Volume 2, are based on observed (rather than posted) operating speeds, and are converted to travel time based on the segment length. For county roads in California which were added to the system, if California Department of Transportation information was not available, HazTrans® national travel time and accident rate assumptions were used based on formulas adopted by the Federal Highway Administration and the American Association of State Highway Transportation Officials.

*Segment Population* - Exposure values were determined by overlaying the "block level" population statistics from the 1990 U.S. Census onto the transportation networks and determining the population residing within each of the pre-defined bandwidths. The "block level" data is the most detailed population data available in a geographically referenced format.

*Risk* - The criteria for determining relative risk is defined by the federal routing criteria guidelines as:

$$RISK_{route} = \sum_{l=1}^L [P(Accident)_l \cdot P(Release) \cdot Consequence_l^{Risk\ Preference}]$$

where  $L$  is the number of segments (or links) in the route,  $P(Accident)_l$  is the accident likelihood along segment  $l$ ,  $P(Release)$  is the likelihood that an accident will result in a release,  $Consequence_l$  is the expected consequences

of a release along segment 1. Beyond representing the Federal definition of risk, HazTrans® risk models can also distinguish between technical and perceived risk. *Risk Preference* is used to represent the differences between public perception and technical judgement.

**Radiological Risks** - The risks associated with normal transport exposure and the public health risk involved with radioactive material shipments are used to calculate a relative radiological risk index.

- **Normal Transport Exposure** - Federal routing guidelines suggests that radiological risk associated with the normal transport of radioactive materials be computed by:

$$D = \begin{array}{c} \text{Dose to persons} \\ \text{residing along the} \\ \text{route} \end{array} + \begin{array}{c} \text{Dose to} \\ \text{passengers in} \\ \text{other vehicles} \end{array} + \begin{array}{c} \text{Dose to} \\ \text{Truck crew} \end{array} + \begin{array}{c} \text{Dose to people} \\ \text{at truck stops} \end{array}$$

Upon review of the California Highway Patrol "Risk Assessments for Transportation of Radioactive Materials on California's Highways (1989)" the "dose to passengers in other vehicles" component of the risk equation was found to zero out. HazTrans® computes the normal transport exposure risk as follows:

$$D = \begin{array}{c} \text{Dose to persons} \\ \text{residing along the} \\ \text{route} \end{array} + \begin{array}{c} \text{Dose to Truck} \\ \text{crew} \end{array} + \begin{array}{c} \text{Dose to people} \\ \text{at truck stops} \end{array}$$

In this calculation, HazTrans® used the length of the route, average speed of the vehicle along the route, and the average population density (in people per square mile within a five mile bandwidth) along the route.

- **Public Health Risk** - The frequency of release-causing accidents and the consequences of such a release are the criteria used to calculate the relative public health risk.

$$\text{Public Health Risk} = \begin{array}{c} \text{Frequency of} \\ \text{Accident} \end{array} \times \begin{array}{c} \text{Consequence} \\ \text{measure} \end{array}$$

Consequence as defined by the federal routing guidelines are a measure of the exposed population computed by:

For rural segments:

$$\text{Consequence measure} = \frac{\text{Population per square mile for a 0 to 5 mile bandwidth}}{\text{Population per square mile for a 5 to 10 mile bandwidth}} \times .75 + \times .25$$

For urban segments:

$$\text{Consequence measure} = \frac{\text{Population per square mile for a 0 to 5 mile bandwidth}}{\text{Population per square mile for a 5 to 10 mile bandwidth}} \times 1.00$$

Normalized values of the normal transport exposure and public health risk are equally weighted to determine the radiological risk as follows:

$$\text{Radiological Risk} = \frac{\text{Normal transport exposure risk bandwidth}}{\text{Public health risk}} \times .5 + \times .5$$

**Emergency response** - This information is currently identified in the HazTrans<sup>®</sup> system in terms of response times from California Highway Patrol field offices to destinations along the proposed routes within the office's jurisdiction.

Routing analyses were conducted with consideration of both overall radiological risk factors and travel time. Routes with physical or legal constraints were eliminated from consideration. Special attention was given to the correlation between population exposure and realistic travel times for commerce. Each route analysis was conducted independently, examining each route alternate for the route offering an acceptable balance between radiological risk and transit time. When the route HazTrans<sup>®</sup> selected to maximize radiological risk was different from the route selected to maximize travel time, the route maximizing overall radiological risk reduction was selected.

Review, verification and validation of the route risk assessment methodology and analyses was conducted by staff and faculty of Vanderbilt University.

##### 5. **Consultative Meeting: Highway Route Controlled Quantity Shipments of Radioactive Materials**

To assist with the implementation process requirements and provide a forum for the consultation suggested by the federal guidelines, a consultative meeting was held in August 1993. Representatives from the following organizations were

invited to attend: radioactive material manufacturers and transporters, California health physicists, engineers and scientists, local government organizations, an environmental group, Department of Health Services, California Department of Transportation, Office of Emergency Services, Office of the State Fire Marshall, Federal Highway Administration, Department of Energy, Nuclear regulatory commission, Abkowitz and Associates, Inc, representatives from adjoining states, and any additional interested parties.

The purpose of the consultative meeting was two-fold:

- (1) To encourage open communication and support for the development of routes by involving government and industry in the implementation process, and
- (2) To consult with government and industry representatives to gain information necessary for the formulation of regulations and the designation of routes.

#### 6. Environmental Impact Analysis

Environmental concerns are addressed as part of the Department's routing study.

The California Highway Patrol is proposing to adopt regulations to designate routes for the through transportation of highway route controlled quantity shipments of radioactive materials. The federal government has established all interstate highways as approved routes. The Department of California Highway Patrol is proposing to designate only those routes necessary for through transportation. The proposed regulations involve no expansion of the current preferred routing system for the shipment of radioactive materials.

In fact, the proposed routes for the through transportation of highway route controlled quantity shipments of radioactive materials will not create additional environmental hazards, but will mitigate and reduce risks already in existence. The Hazardous Materials Transportation Act, as amended, provides the federal government authority to designate routes for both inter- and intra-state transportation of hazardous materials. In the absence of specific state designated routes, transporters are required by federal regulations to use interstate highways. The adoption of these routes will cause no overall increase in highway route controlled quantity shipments of radioactive materials traffic; it will actually reduce highway route controlled quantity shipments of radioactive materials on routes which are not as safe as those proposed in this study.

The California Environmental Quality Act requires consideration of physical effects on the environment for actions such as the adoption of these proposed regulations. The California Highway Patrol has conducted an environmental review according to the California Environmental Quality Act and has determined that the proposed regulations meet the requirements for a categorical exemption under Class 1, Section 15301; and Class 8, Section 15308. In light of the above, the Department proposes to adopt such exemptions at the completion of the regulatory process. The Department's primary environmental consideration has been consistent with the intent of the federal guidelines, preservation of human life. Additionally, environmental factors were given appropriate consideration during the study.

## 7. Background Material

Documentation of the methodology employed in selecting the routes is contained in the California Highway Patrol's "Radioactive Materials Transportation Routing Study - Designation of Routes for the Through Transportation of Highway Route Controlled Quantity Shipments of Radioactive Materials." A copy is contained in the rulemaking file.

### LOCAL MANDATE

These regulations do not impose a new mandate on local agencies or school districts.

### IMPACT ON SMALL BUSINESS

For purposes of these regulations, small businesses are not singled out, or identified, from large businesses. These regulations affect all transporters of Highway Route Controlled Quantity Shipments of Radioactive Materials and it is assumed that both small and large businesses are included in this group. Therefore, The Department has not identified any significant impact on small business.

### ALTERNATIVES

The California Highway Patrol has not identified any alternative that would be more effective in carrying out the purpose for which this action is proposed or would be as effective and less burdensome to affected persons than the proposed action.

### ECONOMIC IMPACT

The Department has determined that these regulations will result in:

- No significant compliance costs for persons or businesses directly affected.
- No discernible impact on the level and distribution of costs and prices for large and small businesses.
- No impact on the level of employment in the state.

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